## Wiring Harnesses

- All input and output signals go through two 18 pin all weather connectors
- Attaches and locks to the ECU

## Fuel Filter

- Plastic cased filter is installed before the pump 10 micron
- Replace every :
  - 24 050 03-S 1500 Hrs
    - Use Support Brackets
  - 24 050 13-S 600 Hrs
  - 25 050 42-S 200 Hrs

24 050 03-S

24 050 13-S

25 050 42-S

## Fuel Line

- Before the Fuel Pump Module use 6.5mm (¼ in.) low pressure fuel line SAE R7 Low Permeation
- After the FPM use high pressure fuel line SAE R9 Low Perm. or R12
- Use screw type or Oetiker® clamps made for high pressure EFI systems

# Electric Fuel Pump Module (FPM)

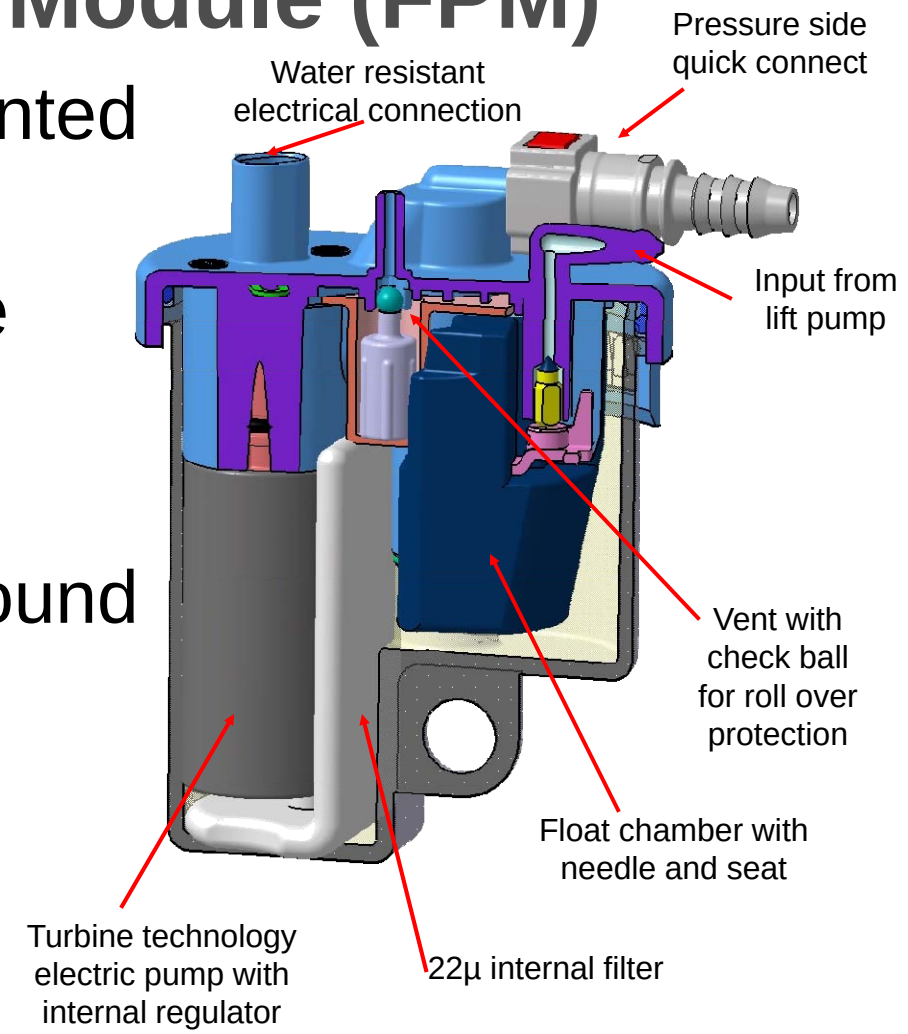
- Standard mechanical or impulse pump is used to deliver fuel from the tank to the fuel pump module
- Module delivers 39psi (2.7 bar) system pressure

# Electric Fuel Pump Module (FPM)

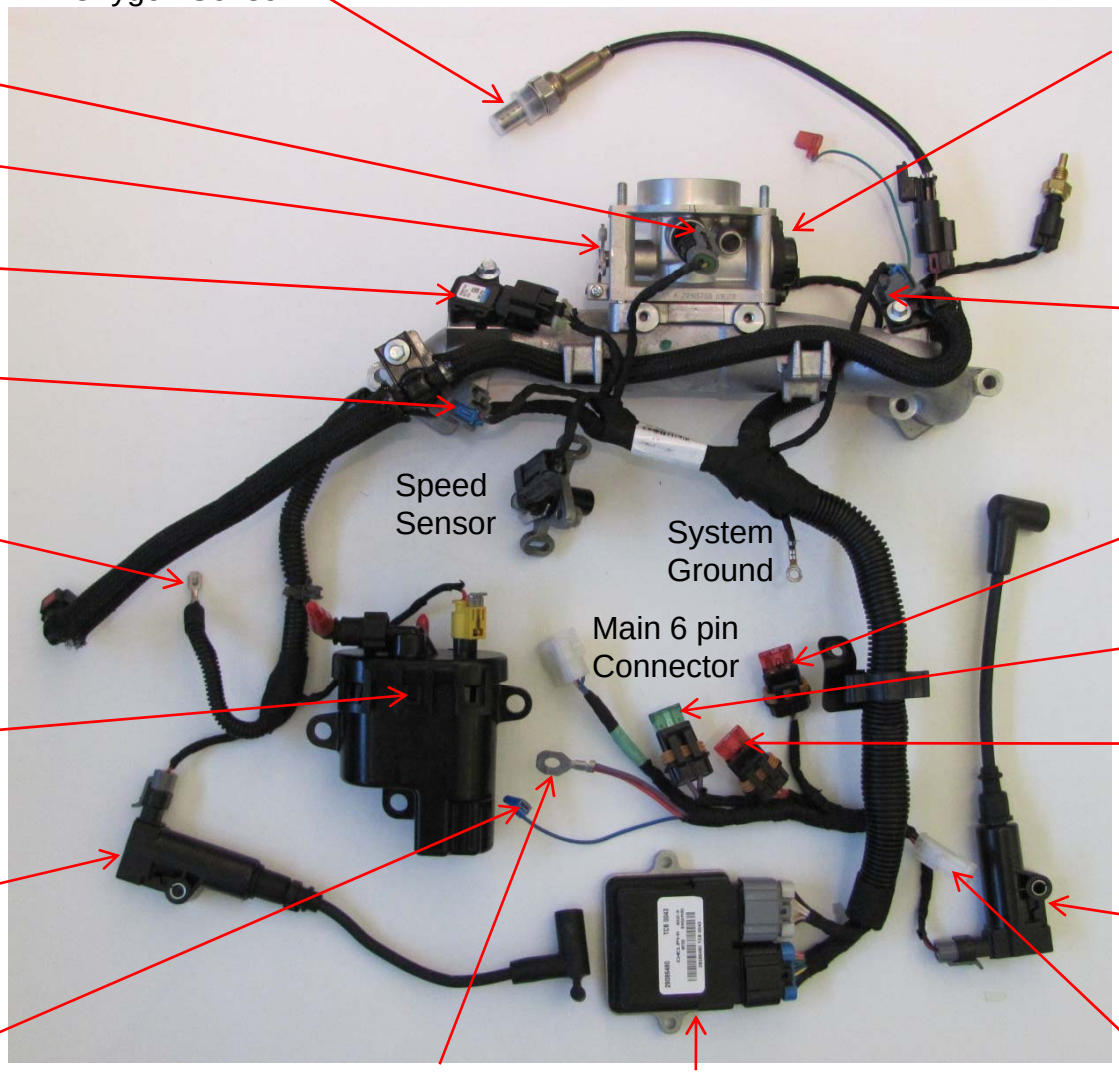
- Fuel pumps are non-serviceable
- Warranty denied if tamper proof mushroom is removed
- **Must** be replaced if a problem is suspected

# Electric Fuel Pump Module (FPM)

- Module is engine mounted
- Internal check valve holds system pressure after the key switch is turned off
- Test procedures are found in the service manual


Water resistant electrical connection
Pressure side quick connect
Input from lift pump
Vent with check ball for roll over protection
Float chamber with needle and seat
Turbine technology electric pump with internal regulator
22µ internal filter

# Commercial EFI System Layout



## From Key “On” to Running

- Key “On” energizes the system
- A barometric pressure reading is taken from the MAP sensor and air temperature from IAT sensor to calculate “Air Density”
- The engine temperature sensor helps determine how much gas is needed to start the engine

## From Key “On” to Running

- Key “Start” energizes the starter
- The speed sensor tells the ECU how fast the engine is rotating and where TDC is located
- With all this input the engine has enough information to start in “Batch Fire”
- Always use a constant “On” key switch

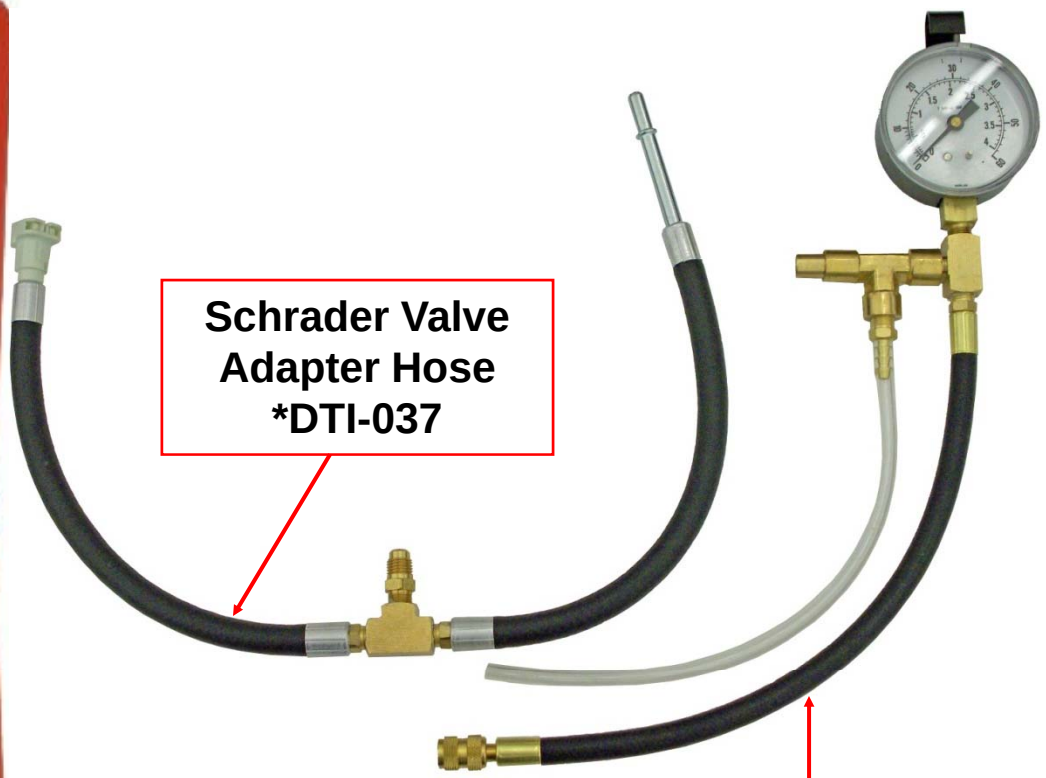
# From Key “On” to Running

- The MAP sensor is located next to one of the intake ports to help determine the correct stroke to run “Sequential Injection”
- Within seconds the heated Oxygen sensor can measure the oxygen content in the exhaust to run in “Closed Loop”
  - ETS >140°F(60°C) closed loop active
  - ETS >176°F(80°C) long term adaption

# Troubleshooting

- Before faulting the EFI system make sure the engine is in good mechanical condition.
  - Spark
  - Compression
  - Cylinder Leakage Test
  - Crankcase Vacuum
  - Check for debris in tank, plugged cap vent, kinked or pinched fuel lines etc.

# EFI Service Tool Kit **24 761 01-S**



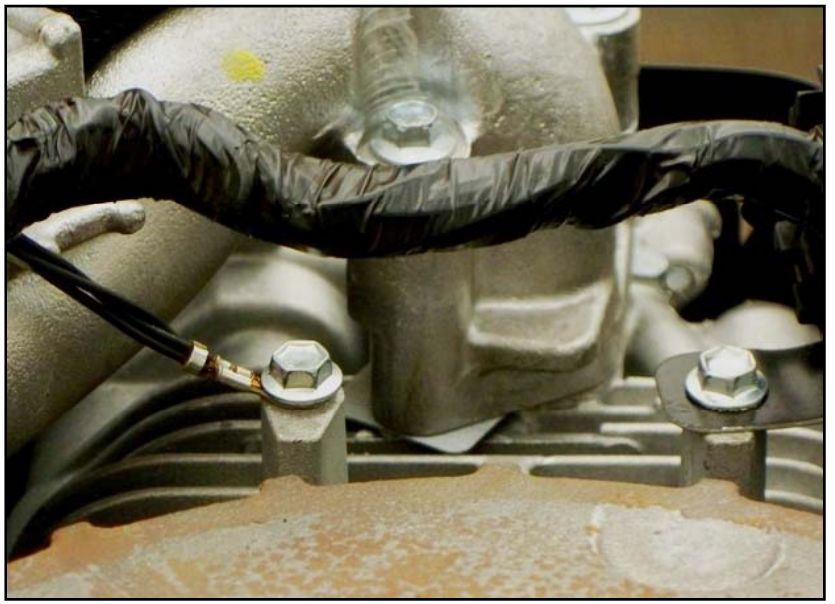

Hoses for Fitting

90° Adapter

*See Parts Bulletin 228

# Troubleshooting Electrical System

- Most EFI related problems are caused by poor wiring connections and/or faulty ground(s).
- Even small amounts of corrosion can interfere with milliamp currents in the system.



## Troubleshooting Fuel System

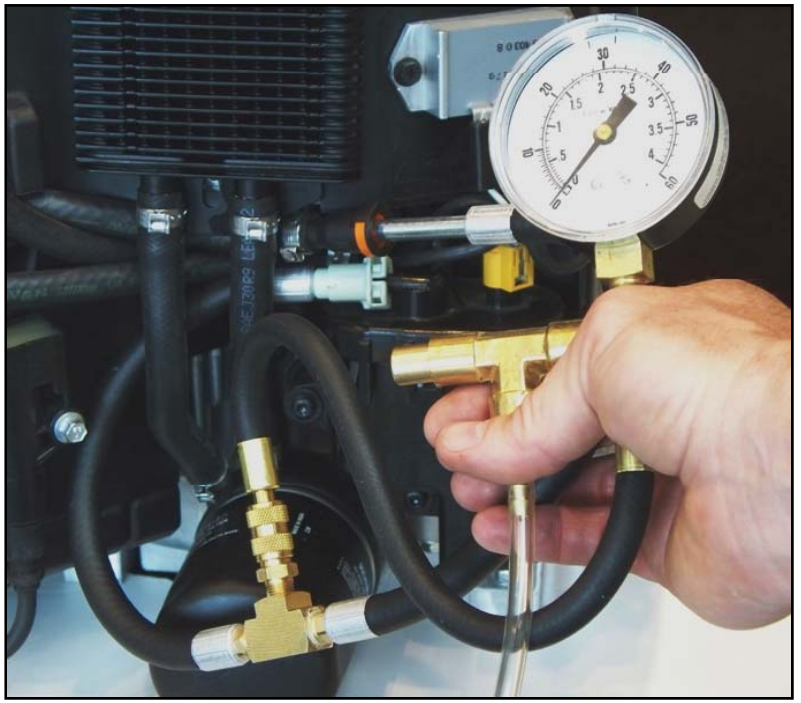
- To check for fuel delivery, attach a spark tester.
- Crank the engine for 3 seconds, then remove the spark plug and check the tip for fuel.

If no fuel is found:

- Check the battery voltage.
- Check the fuel pump fuse and connections.
- Check fuel pressure.

# Troubleshooting Fuel System

- Test fuel pressure at the Fuel Pump Module using a fuel pressure gauge
  - **Warning:**
    The fuel system is under high pressure (39 psi). The pressure will be relieved when the connection is opened.



## Fault Codes

- The Malfunction Indicator Light (MIL) signals a system fault code
- MIL will remain “On” as long as the fault is current
- If the MIL turns “On” then “Off” a code will be stored in memory as historic

## Fault Codes

- Access codes using the key switch
- Turn the key “On”-”Off”-”On”-”Off”-”On” within 2.5 seconds
- If the MIL turns “On” then “Off” a code will be stored in memory

## Fault Codes

- Codes are displayed as four digit power train codes (“P” code)
- Each digit will be from 1-10 blinks followed by a pause (0 = 10 blinks)
- The last code in a series to display will always be 61

# Fault Codes

- Fault codes will continue to cycle until the key is turned “Off”
- If no other faults are present code 61 will display followed by a pause then the light will remain on
  - This is not code 62 but simply 61 with a pause before the light remains “On”

# EFI Troubleshooting

| Component | "P"Code | Description | Cause |
|---|---|---|---|
| $O^2$ Sensor Heater | 0031 | $O^2$ Heater Circuit High Voltage | System voltage too high. Shorted connection. Faulty connection. |
| | 0032 | $O^2$ Heater Circuit Low Voltage | System voltage too low. Open connection/broken wire. Faulty sensor. |
| Manifold Absolute Pressure Sensor (MAP) | 0107 | MAP Circuit Low Voltage or Open | Intake manifold leak. Open connection/broken wire (Black pin 11/green wire). Faulty sensor. |
| | 0108 | MAP Circuit High Voltage | Intake manifold leak. Shorted connection. Faulty sensor. |
| Intake Air Temperature Sensor (IAT) | 0112 | Intake Air Temperature Sensor Circuit Low Voltage | Shorted connection. Faulty sensor. |
| | 0113 | Intake Air Temperature Sensor Circuit High Voltage or Open | Open connection/broken wire. Faulty sensor. |
| Coolant/Oil Temperature Sensor | 0117 | Coolant/Oil Temperature Sensor Circuit Low Voltage | Shorted connection. Faulty sensor. Shorted wire. |
| | 0118 | Coolant/Oil Temperature Sensor Circuit High Voltage or Open | Open connection/broken wire. Faulty Sensor. Shorted wire. |
| Throttle Position Sensor (TPS) | 0122 | TPS Circuit Low Voltage or Open | Throttle shaft or bearings worn/damaged. Open connection/broken wire. Faulty sensor. |
| | 0123 | TPS Circuit High Voltage | Throttle shaft or bearings worn/damaged. Shorted connection. Faulty sensor. |

# EFI Troubleshooting

| Component | "P"Code | Description | Cause |
|---|---|---|---|
| Oxygen ($O^2$) Sensor | 0131 | $O^2$ Sensor Circuit Low Voltage | Open connection. Faulty sensor. |
| | 0132 | $O^2$ Sensor Circuit High Voltage | Shorted connection. Faulty sensor. |
| Fuel System | 0171 | High Maximum Adaptation Limit Exceeded | Fuel inlet screen/filter plugged. Low system fuel pressure. TPS malfunction. Shorted connection. Faulty sensor. |
| | 0172 | Low Maximum Adaptation Limit Exceeded | System fuel pressure too high. TPS malfunction. Shorted connection. Faulty $O^2$ sensor. |
| | 0174 | Lean Fuel Condition | Fuel inlet screen/filter plugged. Low system fuel pressure. TPS malfunction. Open connection to $O^2$. Faulty $O^2$ sensor. |
| Fuel Injector | 0201 | Injector 1 Circuit Malfunction | Fuel supply to injector blocked or damaged. Faulty injector. Bad fuse. Open connection/broken wire. Faulty sensor. |
| | 0202 | Injector 2 Circuit Malfunction | Fuel supply to injector blocked or damaged. Faulty injector. Bad fuse. Open connection/broken wire. Faulty sensor. |
| Fuel Pump Module (FPM) | 0230 | Circuit Low Voltage or Open | Bad fuse. Open connection/broken wire. |
| | 0232 | Circuit High Voltage | Shorted connection. |

# EFI Troubleshooting

| Component | "P"Code | Description | Cause |
|---|---|---|---|
| Crankshaft Position Sensor | 0336 | Crankshaft Position Sensor Noisy Signal | Air gap incorrect. Loose sensor. Faulty/bad battery. Non-resistor sparks plugs installed. Shorted connection. Faulty sensor. |
| | 0337 | Crankshaft Position Sensor No Signal | Air gap incorrect. Loose sensor. Shorted connection. Faulty sensor. |
| Ignition Coil | 0351 | Cylinder 1 Ignition Coil Malfunction | Broken wire in harness (may not be visible). Shorted connection. Faulty sensor. |
| | 0352 | Cylinder 2 Ignition Coil Malfunction | Broken wire in harness (may not be visible). Shorted connection. Faulty sensor. |
| System Voltage | 0562 | System Voltage Low | Faulty voltage regulator. Bad fuse. Shorted connection. Corroded connection. Bad battery. |
| | 0563 | System Voltage High | Faulty voltage regulator. Shorted connection. |
| End of Fault Codes | 61 | | Code(s) end. |

# Diagnostic Software Kit (25 761 23-S)

- Displays power train codes
- Identifies components/sensors/harness locations involved in each code
- Guided diagnostics help identify the failure

# Diagnostic Software Kit (25 761 23-S)

- View operating conditions
  - RPM
  - Spark advance
  - Injector time
  - Battery voltage
- View sensor outputs
  - Throttle position
  - Manifold Absolute Pressure
  - $O^2$ voltage
  - Temperatures (engine & intake air)

# Diagnostic Software Kit (25 761 23-S)

- View historic values
  - Max. RPM, Battery Voltage, Engine & Intake Air Temperature
  - Time at Idle, Low, Medium, High speed ranges
  - Time at Low, Medium, High Loads
  - Hour meters (current, trip & total)

# Diagnostic Software Kit (25 761 23-S)

Kit Includes:

- Software CD with Serial Number
- Diagnostic interface cable
- USB to Serial adapter
- Instruction Booklet

# Diagnostic Software Kit (25 761 23-S)

Free Upgrade in Version 2.11

- If Less Than 2.11.0006
- www.kohler.diagsys.com

# Diagnostic Software Kit (25 761 23-S)

Upgrade Older Kits

- 25 761 25-S Version 2.11 CD
- 25 455 19-S Adapter Serial Port to USB

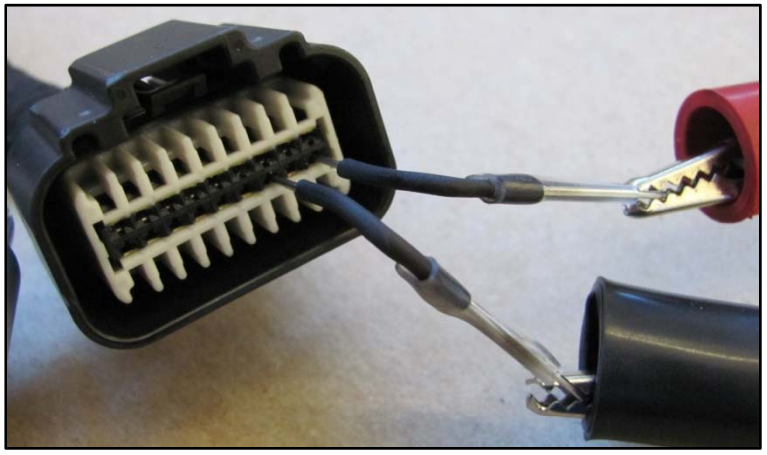
# Diagnostic Software Kit (25 761 23-S)

- Diagnostic cable attaches to the EFI system at the 4-pin diagnostic connector

## Basic System Tests

- Test continuity through the ECU connector plugs
- Caution: Connector terminals are small and can be damaged if too large of probe is used (Probe Max. Dia. .032” approx.)

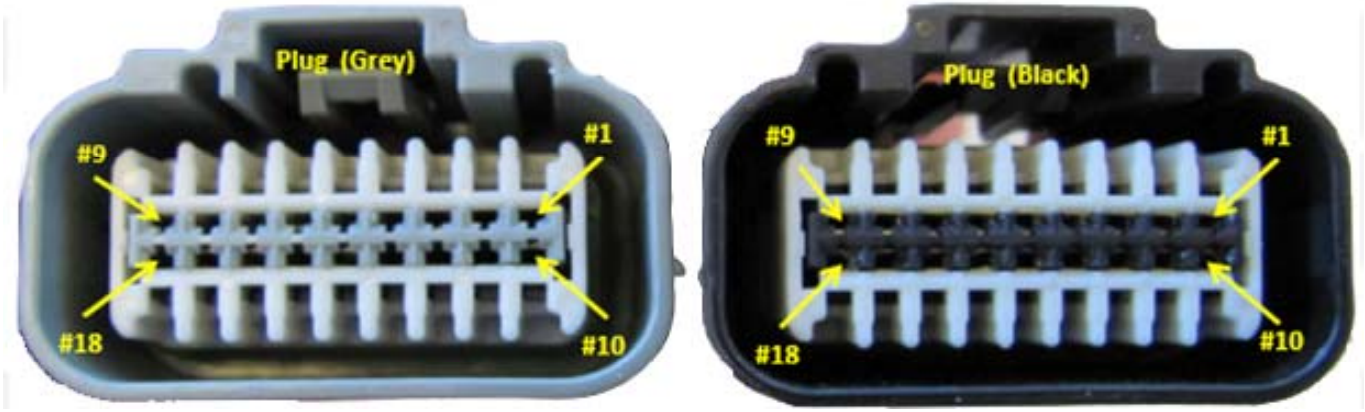
Note: A shielded / modified paper clip works well.



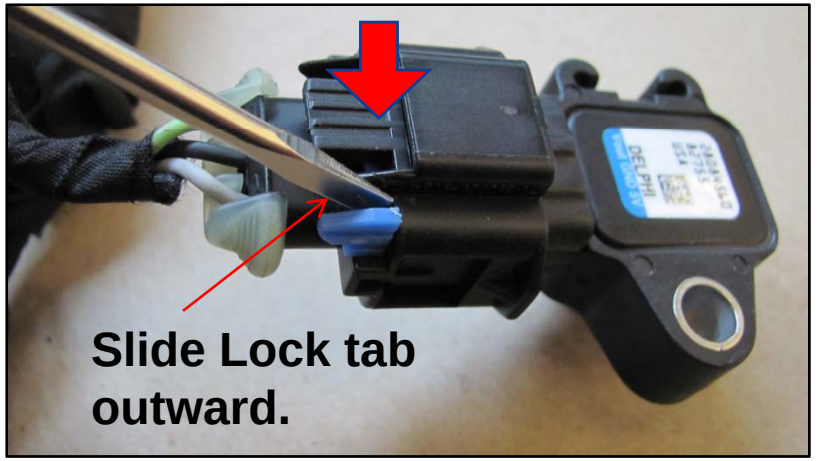
# EFI Troubleshooting

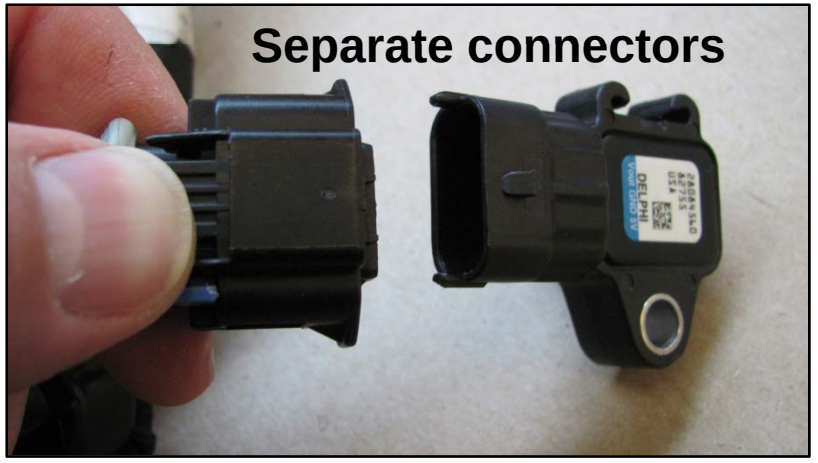
| Pin | Grey Connector |
|---|---|
| 1 | OPEN (Not Used) |
| 2 | OPEN (Not Used) |
| 3 | MIL (Tan) Light Ground |
| 4 | OPEN (Not Used) |
| 5 | OPEN (Not Used) |
| 6 | OPEN (Not Used) |
| 7 | OPEN (Not Used) |
| 8 | OPEN (Not Used) |
| 9 | Ground (Black) |
| 10 | Coil #2 (Purple) Ground Control |
| 11 | OPEN (Not Used) |
| 12 | OPEN (Not Used) |
| 13 | OPEN (Not Used) |
| 14 | Kill Wire (Wite) 10V Potential |
| 15 | OPEN (Not Used) |
| 16 | Diagnostic (White) Re-Set Line |
| 17 | Fuel Pump Power (Red) Switched |
| 18 | OPEN (Not Used) |

| Pin | Black Connector |
|---|---|
| 1 | Coil#1 (Black) Ground Control |
| 2 | Ground (Black) |
| 3 | ECU (Drk Blue) Communication |
| 4 | Crank Sensor HI (Yellow) |
| 5 | INJ #1 (Drk Blue) Ground Control |
| 6 | INJ #2 (Drk Green) Ground Control |
| 7 | $O^2$ Heater (Drk Green) Ground Control |
| 8 | IAT (Tan) Ground Control |
| 9 | FPM (Pink) Ground Control |
| 10 | 5V Return (Black) Main Sensor Power |
| 11 | MAP Sensor (Lt Green) |
| 12 | TPS (Drk Blue) |
| 13 | Crank Sensor LO (Purple) |
| 14 | Oil Temp (Drk Green) Ground Return |
| 15 | Power (Red) Switched |
| 16 | 5V Return (Grey) Reference Voltage |
| 17 | $O^2$ HI (Purple) Ground Control |
| 18 | Memory Power (Red) Un-Switched |

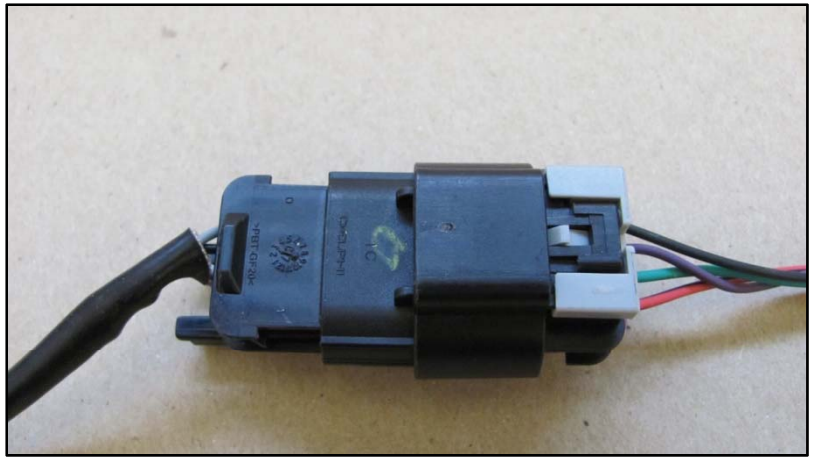


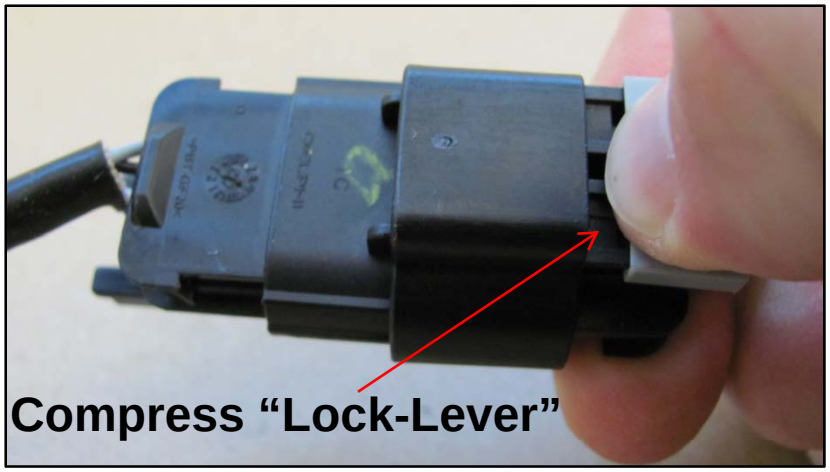
# MAP Sensor Connector Details

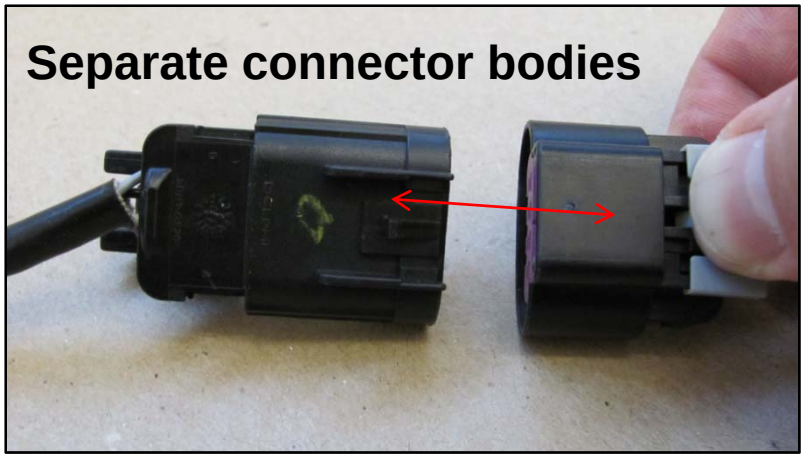




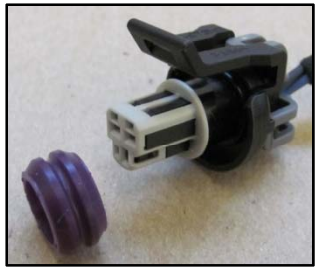
# Oxygen Sensor Connector Plug Details

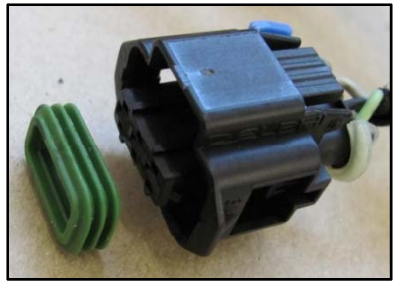


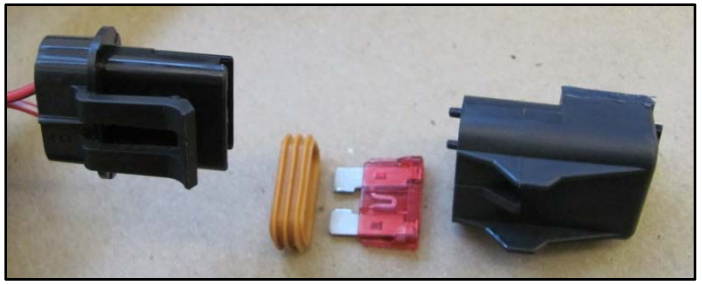


## Connector Body Seals & Gaskets







To insure the integrity of sensor connection, visibly inspect the connector gasket / seal whenever the connector is opened

# Any Questions?